

Claims

1. A circuit device for providing energy to at least one electrical component, said circuit device comprising:

a positive contact;

a negative contact;

an inductor;

a diode having a cathode end and an anode end;

a first component contact for electrical connection to a cathode end of an electrical component;

a second component contact for electrical connection to an anode end of an electrical component;

a switch; and

a control device,

a first end of said inductor being electrically connected to said positive contact;

a second end of said inductor being electrically connected to said anode end of said diode;

a first end of said switch being electrically connected to a junction between said second end of said inductor and said anode end of said diode;

a second end of said switch being electrically connected to said negative contact;

said second component contact being electrically connected to said cathode end of said diode;

said first component contact being electrically connected to a junction between said positive contact and said first end of said inductor;

said control device having a current sensing terminal and an output terminal, said current sensing terminal being electrically connected to a junction between said second end of said switch and said negative contact, said output terminal being electrically connected to said switch, said control device causing said switch to break electrical connection across said switch when voltage at said current sensing terminal exceeds a threshold value, and causing said switch to provide electrical connection across said switch after a non-conduction period has elapsed following said causing said switch to break electrical connection.

2. A circuit device as recited in claim 1, wherein said switch comprises a switching transistor having a collector, a base and an emitter, said collector being electrically connected to said junction between said second end of said inductor and said anode end of said diode, said base being electrically connected to said output terminal of said control device, and said emitter being electrically connected to said negative contact.

3. A circuit device as recited in claim 1, further comprising a current sense resistor having a first end and a second end, said first end of said current sense resistor being electrically connected to a junction between said second end of said switch and said current sensing terminal, said second end of said current sense resistor being electrically connected to said negative terminal.

4. A circuit device as recited in claim 1, further comprising a current sense resistor, a current sense series resistor, a bias resistor and a Zener diode,
said current sense resistor having a first end and a second end,
said current sense series resistor having a first end and a second end,
said bias resistor having a first end and a second end,
said Zener diode having a cathode end and an anode end,
said cathode end of said Zener diode being electrically connected to a junction between said positive contact and said first end of said inductor, said anode end of said Zener diode being electrically connected to said first end of said bias resistor,
said second end of said bias resistor being electrically connected to a junction between said first end of said current sense series resistor and said current sensing terminal,
said second end of said current sense series resistor being electrically connected to a junction between said second end of said switch and said first end of said current sense resistor,
said second end of said current sense resistor being electrically connected to said negative terminal.

5. A circuit device as recited in claim 1, further comprising a capacitor having a first end and a second end, said first end of said capacitor being electrically connected to a

junction between said cathode end of said diode and said second component contact, said second end of said capacitor being electrically connected to a junction between said second end of said switch and said negative contact.

6. A circuit device as recited in claim 1, wherein said switch comprises a switching transistor having a collector, a base and an emitter,

said circuit device further comprising a current sense resistor, a current sense series resistor, a bias resistor, a Zener diode and a capacitor,

said current sense resistor having a first end and a second end,

said current sense series resistor having a first end and a second end,

said bias resistor having a first end and a second end,

said Zener diode having a cathode end and an anode end,

said capacitor having a first end and a second end,

said cathode end of said Zener diode being electrically connected to a junction between said positive contact and said first end of said inductor, said anode end of said Zener diode being electrically connected to said first end of said bias resistor,

said second end of said bias resistor being electrically connected to a junction between said first end of said current sense series resistor and said current sensing terminal,

said second end of said current sense series resistor being electrically connected to said first end of said current sense resistor,

said second end of said current sense resistor being electrically connected to said negative terminal,

said collector being electrically connected to said junction between said second end of said inductor and said anode end of said diode, said base being electrically connected to said output terminal of said control device, and said emitter being electrically connected to a junction between said second end of said current sense series resistor and said first end of said current sense resistor,

said first end of said capacitor being electrically connected to a junction between said cathode end of said diode and said second component contact, said second end of said capacitor being electrically connected to a junction between said second end of said current sense resistor and said negative contact.

7. A circuit device as recited in claim 1, wherein said electrical component is an LED.
8. An electrical component receiving assembly, comprising:
a circuit device as recited in claim 1; and
a bulb base, said circuit device being positioned inside said bulb base.
9. An electrical component receiving assembly as recited in claim 8, further comprising insulating material at least partially filling space between said bulb base and said circuit device.
10. An electrical component receiving assembly as recited in claim 8, wherein an exterior surface of said bulb base is textured, thereby increasing a surface area of said exterior surface.
11. A flashlight, comprising:
a casing;
a bulb base, said bulb base being positioned inside said casing; and
a circuit device as recited in claim 1, said circuit device being positioned inside said bulb base.
12. A flashlight as recited in claim 11, further comprising insulating material at least partially filling space between said bulb base and said circuit device.
13. A flashlight as recited in claim 11, wherein an exterior surface of said bulb base is textured, thereby increasing a surface area of said exterior surface.
14. A light emitting diode-containing device comprising:
a positive contact;
a negative contact;
an inductor;
a diode having a cathode end and an anode end;

a light emitting diode component having a cathode end and an anode end;
a switch; and
a control device,
a first end of said inductor being electrically connected to said positive contact;
a second end of said inductor being electrically connected to said anode end of said diode;
a first end of said switch being electrically connected to a junction between said second end of said inductor and said anode end of said diode;
a second end of said switch being electrically connected to said negative contact;
said anode end of said light emitting diode component being electrically connected to said cathode end of said diode;
said cathode end of said light emitting diode component being electrically connected to a junction between said positive contact and said first end of said inductor;
said control device having a current sensing terminal and an output terminal, said current sensing terminal being electrically connected to a junction between said second end of said switch and said negative contact, said output terminal being electrically connected to said switch, said control device causing said switch to break electrical connection across said switch when voltage at said current sensing terminal exceeds a threshold value, and causing said switch to provide electrical connection across said switch after a non-conduction period has elapsed following said causing said switch to break electrical connection.

15. A light emitting diode-containing device as recited in claim 14, wherein said switch comprises a switching transistor having a collector, a base and an emitter, said collector being electrically connected to said junction between said second end of said inductor and said anode end of said diode, said base being electrically connected to said output terminal of said control device, and said emitter being electrically connected to said negative contact.

16. A light emitting diode-containing device as recited in claim 14, further comprising a current sense resistor having a first end and a second end, said first end of said current sense resistor being electrically connected to a junction between said second end of

said switch and said current sensing terminal, said second end of said current sense resistor being electrically connected to said negative terminal.

17. A light emitting diode-containing device as recited in claim 14, further comprising a current sense resistor, a current sense series resistor, a bias resistor and a Zener diode,

said current sense resistor having a first end and a second end,

said current sense series resistor having a first end and a second end,

said bias resistor having a first end and a second end,

said Zener diode having a cathode end and an anode end,

said cathode end of said Zener diode being electrically connected to a junction between said positive contact and said first end of said inductor, said anode end of said Zener diode being electrically connected to said first end of said bias resistor,

said second end of said bias resistor being electrically connected to a junction between said first end of said current sense series resistor and said current sensing terminal,

said second end of said current sense series resistor being electrically connected to a junction between said second end of said switch and said first end of said current sense resistor,

said second end of said current sense resistor being electrically connected to said negative terminal.

18. A light emitting diode-containing device as recited in claim 14, further comprising a capacitor having a first end and a second end, said first end of said capacitor being electrically connected to a junction between said cathode end of said diode and said anode end of said light emitting diode component, said second end of said capacitor being electrically connected to a junction between said second end of said switch and said negative contact.

19. A light emitting diode-containing device as recited in claim 14, wherein said switch comprises a switching transistor having a collector, a base and an emitter, said device further comprising a current sense resistor, a current sense series resistor, a

bias resistor, a Zener diode and a capacitor,

said current sense resistor having a first end and a second end,

said current sense series resistor having a first end and a second end,

said bias resistor having a first end and a second end,

said Zener diode having a cathode end and an anode end,

said capacitor having a first end and a second end,

said cathode end of said Zener diode being electrically connected to a junction between said positive contact and said first end of said inductor, said anode end of said Zener diode being electrically connected to said first end of said bias resistor,

said second end of said bias resistor being electrically connected to a junction between said first end of said current sense series resistor and said current sensing terminal,

said second end of said current sense series resistor being electrically connected to said first end of said current sense resistor,

said second end of said current sense resistor being electrically connected to said negative terminal,

said collector being electrically connected to said junction between said second end of said inductor and said anode end of said diode, said base being electrically connected to said output terminal of said control device, and said emitter being electrically connected to a junction between said second end of said current sense series resistor and said first end of said current sense resistor,

said first end of said capacitor being electrically connected to a junction between said cathode end of said diode and said anode end of said light emitting diode component, said second end of said capacitor being electrically connected to a junction between said second end of said current sense resistor and said negative contact.

20. A light emitting diode-containing device as recited in claim 14, wherein said light emitting diode component comprises a plurality of LEDs.

21. A light emitting diode-containing device as recited in claim 14, wherein said light emitting diode component produces light emission, a greater part of said light emission being in a direction normal to a vertical axis of said light emitting diode component.

22. A light emitting diode assembly, comprising:
a device as recited in claim 14; and
a bulb base, said light emitting diode component being secured to said bulb base, at least a portion of said device being positioned inside said bulb base.

23. A light emitting diode assembly as recited in claim 22, further comprising insulating material at least partially filling space between said bulb base and said device.

24. A light emitting diode assembly as recited in claim 22, wherein said light emitting diode component is bonded to said bulb base with an electrically insulating adhesive material.

25. A light emitting diode assembly as recited in claim 22, wherein an exterior surface of said bulb base is textured, thereby increasing a surface area of said exterior surface.

26. A light emitting diode assembly as recited in claim 22, wherein said light emitting diode component produces light emission, a greater part of said light emission being in a direction normal to a vertical axis of said light emitting diode component.

27. A flashlight, comprising:
a casing;
a bulb base, said bulb base being positioned inside said casing; and
a device as recited in claim 14, at least a portion of said device being positioned inside said bulb base.

28. A flashlight as recited in claim 27, further comprising insulating material at least partially filling space between said bulb base and said device.

29. A flashlight as recited in claim 27, wherein an exterior surface of said bulb base is textured, thereby increasing a surface area of said exterior surface.

30. A flashlight as recited in claim 27, wherein said light emitting diode component produces light emission, a greater part of said light emission being in a direction normal to a vertical axis of said flashlight.

31. A circuit device for providing energy to at least one electrical component, said circuit device comprising:

- a positive contact;
- a negative contact;
- an inductor;
- a first diode having a cathode end and an anode end;
- a first component contact for electrical connection to a cathode end of an electrical component;
- a second component contact for electrical connection to an anode end of an electrical component;
- a switch;
- a control device having a current sensing terminal and an output terminal;
- a current sense series resistor having a first end and a second end;
- a bias resistor having a first end and a second end; and
- a Zener diode having a cathode end and an anode end,
- a first end of said inductor being electrically connected to said positive contact;
- a second end of said inductor being electrically connected to said anode end of said first diode;
- a first end of said switch being electrically connected to a junction between said second end of said inductor and said anode end of said first diode;
- a second end of said switch being electrically connected to said negative contact;
- said second component contact being electrically connected to said cathode end of said first diode;
- said first component contact being electrically connected to said negative contact;
- said cathode end of said Zener diode being electrically connected to a junction between said positive contact and said first end of said inductor, said anode end of said Zener diode being electrically connected to said first end of said bias resistor,

said second end of said bias resistor being electrically connected to a junction between said first end of said current sense series resistor and said current sensing terminal,

said second end of said current sense series resistor being electrically connected to a junction between said second end of said switch and said negative terminal;

said output terminal being electrically connected to said switch, said control device causing said switch to break electrical connection across said switch when voltage at said current sensing terminal exceeds a threshold value, and causing said switch to provide electrical connection across said switch after a non-conduction period has elapsed following said causing said switch to break electrical connection.

32. A circuit device as recited in claim 31, further comprising a capacitor having a first end and a second end, said first end of said capacitor being electrically connected to a junction between said cathode end of said first diode and said second component contact, said second end of said capacitor being electrically connected to said negative contact.

33. A circuit device as recited in claim 31, wherein said electrical component comprises at least one LED.

34. A circuit device as recited in claim 31, further comprising a current sense resistor having a first end and a second end, said first end of said current sense resistor being electrically connected to a junction between said second end of said current sense series resistor and said second end of said switch, said second end of said current sense resistor being electrically connected to said negative contact.

35. A circuit device as recited in claim 31, wherein said light emitting diode component produces light emission, a greater part of said light emission being in a direction normal to a vertical axis of said light emitting diode component.

36. A method of directly replacing a flashlight bulb, comprising:
inserting into a flashlight body a light emitting diode assembly as recited in claim 22.